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Title: AN IMPROVED OPEN-ANGLE SEAT FOR A CHAIR**FIELD OF THE INVENTION**

This invention relates to open-angle seats for chairs.

5

BACKGROUND OF THE INVENTION

The natural upright curvature of a human spine is found when a person stands. While standing the psoas major muscle pulls on the lumbar vertebrae of the lower back to help define the standing posture.

10 When a person sits in a classic right angle position—with the thighs at roughly a 90° angle to the trunk of the body—the psoas major muscle relaxes and no longer pulls on the lumbar vertebrae. Further, the hamstring muscles located at the back of the thighs pull on the pelvis, causing it to rotate backwardly. This results in the spine becoming

15 rounded. In order to restore an upright curvature to the spine, the lumbar muscles of the lower back work to push the pelvis forward to counteract the pull by the hamstring muscles. Eventually, the lumbar muscles tire. The hamstring muscles rotate the pelvis backwards, and the spine becomes rounded once again. This posture, typically referred to as

20 slouching, becomes a posture of choice simply because it requires the least amount of muscular effort. After several years of sitting at a desk or working at a computer, the sitting posture worsens and can result in other problems, such as rounded shoulders, pressure on abdominal organs, extension of the neck, and lower back pain. In some instances, serious

25 chronic injury can result. It has therefore been recognized that there is a need for a seat that restores the natural upright curvature to the spine when a person sits.

Research has identified a relationship between a person's thighs and spine, which led to the creation of an open-angle chair. Open-angle chairs allow the thighs to drop creating an angle with the trunk of the body that is greater than 90°. This results in positive biomechanical changes in spinal and pelvic posture. In particular, the hamstring muscles no longer pull on the pelvis, allowing it to roll forward, and the psoas major

muscle no longer completely relaxes, and so maintains some of its pull on the lumbar vertebrae. The interaction of these muscles allows the spine to maintain a natural upright curvature.

One type of open-angle chair is the saddle seat (see, for example, U. S. patent Nos. 3,754,787 and 4,607,882), which was inspired by horseback riding. A straddling position allows the thighs to drop yet provides support to the inner surface of the thighs that adds stability to the sitting posture. Saddle seats, however, provide no weight bearing support under the thighs so that the full load of the trunk of the body is concentrated on the two sit bones (ischial tuberosities) which, over time, can be painful. Saddle seats also cause the legs to spread excessively, which, over time, can cause numbness and discomfort to the inner thighs. Further, for many people, saddle seats are difficult to get in and out of.

Other forms of open-angle chairs generally involve tilting the seat, as found in, for example, U. S. patent Nos. 4,552,404 and 4,960,305. Tilted seats provide for some weight bearing support under the buttocks and thighs of a person, and the legs are not spread so no numbness or discomfort to the inner thighs results from prolonged sitting. Tilted seats, however, have the problem that the trunk of the body slides forward under gravity and this downward force must be counteracted by muscle activity in the legs and feet. Over time, this can result in increased fatigue and discomfort. Kneeling chairs are variations of the tilt seat and have the addition of a cushion provided below the knees to redirect the downward pressure caused by gravity from the legs and feet to the shins of a person. Kneeling chairs, for many people, are difficult to get in and out of.

It is also known that perching (sitting at the forward edge of a seat of a chair) offers biomechanical advantages to sitting posture. The angle between the spine and the thighs in perching is similar to horseback riding and similar to saddle chairs. Chairs that utilize the advantages of perching (see, for example, U. S. patent No. 5,253,922, which combines perching with certain elements of a saddle seat) are generally higher than conventional chairs, but suffer from similar problems as tilted seats in that most of the support is provided by the feet.

Furthermore, perching provides no weight bearing support under the thighs so that the load of the trunk of the body is concentrated on the sit bones.

Accordingly, there is a need for a seat for a chair that provides
5 independent support surfaces to the sit bones and the thighs, but also provides the open-angle benefits to the spine as described above.

SUMMARY OF THE INVENTION

This invention relates to an improved open-angle seat, and,
10 in particular, a chair that uses the improved open-angle seat of this invention. The improved seat of this invention provides independent support to both a person's sit bones (ischial tuberosities) and thighs. In particular, the seat comprises a first support surface to support the downward load of a person's trunk at the sit bones, when the first support
15 surface is disposed in a first plane. The seat also has a second support surface to support a person's thighs. The second support surface is disposed generally forwardly of the first support surface in a second plane angled downwardly in relation to the first plane.

More particularly, the seat comprises a first support surface,
20 with the first support surface being generally planar and adapted to support a person seated on the seat at the sit bones. A second support surface is also provided, with the second support surface being generally planar and adapted to support the person seated on the seat at the thighs. The plane of the first support surface and the plane of the second support
25 surface intersect so that when the first support surface is generally horizontal, the second support surface extends generally forwardly and downwardly with respect to the first support surface.

In the preferred embodiment the first support surface is a generally planar surface having a perimetrical extent sufficient to extend
30 under a person's buttocks to support the sit bones. Moreover, in the preferred embodiment the second support surface is a generally planar surface having a perimetrical extent sufficient to extend under and support a person's thighs.

The second support surface preferably extends under a person's thighs a distance sufficient to support the thighs, but less than the extent of a person's thighs from the hips to the knees. In particular, the second support surface has a forward facing edge and the front-to-back length of the second support surface is such that the forward facing edge is located just before a person's knees. This allows a person sitting on a seat of this invention to bend the knees. For an average person this length is equal to the length of the hand, measured from wrist to the end of the middle finger. Measuring the hand as described provides a relatively easy and accurate way to determine the front-to-back length for the second support surface. It is generally difficult to obtain a direct measurement of this length from the thighs of a person since it is usually difficult to determine where, at the top of the legs of a typical person, the thighs begin.

It is preferable that the second support surface is angled downwardly in relation to the first support surface by an angle ranging from about 10° to about 30°, and, in the preferred embodiment, by an angle of about 20°.

The first support surface of the seat is preferably disposed in a plane that is generally horizontal and at a height above a floor the lesser of:

- a.) generally 1/3 of a person's standing height; and
- b.) the length of a person's legs measured from the floor to a height slightly above the knees.

Further, the preferred embodiment of this invention has the first support surface and the second support surface joined along a common edge. The common edge has a rounded profile which, in the preferred embodiment, is about 12 cm. radius.

In one alternative embodiment of the seat, a pommel is provided to support the inner surface of the thighs and enhance lateral stability when a person sits, particularly when the person reaches or shifts positions. The pommel extends upwardly from the support surfaces.

This invention also provides for a method of constructing a chair for a specific person with a seat that provides independent support to both the person's sit bones and thighs, as described above. The method particularly comprises obtaining certain measurements from the person
5 and using those measurements to select and arrange the support surfaces in the chair. The measurements include:

10 a.) obtaining a measurement for the height of the first support surface above a floor so a person can sit in the chair with the feet resting on the floor and the second support surface providing independent support to the thighs; and
b.) obtaining a measurement for the front-to-back length of the second support surface so that a forward facing edge of such support surface is located just before a person's knees.

15 These measurements are used to select and arrange the support surfaces in the chair including:

20 I.) arranging the first support surface in the chair at the height determined in step a.) above with the first support surface disposed in a first plane; and
II.) arranging the second support surface having a front-to-back length determined from step b.) above in the chair generally forwardly of the first support surface in a second plane angled downwardly in relation to the first plane.

In the preferred method of the invention the measurement
25 obtained from step a.) above is a measurement from the person which is the lesser of:

i.) generally 1/3 of a person's standing height; and
ii.) the length of a person's legs measured from the floor to a height slightly above the knees

30 In the preferred method of the invention the measurement obtained from step b.) above is a measurement of the length of a hand of the person as measured from the wrist to the end of the middle finger. Measuring the hand as described provides a relatively easy and accurate

way to determine the front-to-back length for the second support surface. It is generally difficult to obtain a direct measurement of this length from the thighs of a person since it is usually difficult to determine where, at the top of the legs of a typical person, the thighs begin.

5 In the preferred method of the invention, step II.) above further comprises angling second support surface downwardly in relation to the first support surface by an angle ranging from about 10° to about 30°, and preferably by an angle of about 20°.

10 BRIEF DESCRIPTION OF THE DRAWING FIGURES

For a better understanding of the present invention and to show more clearly how it would be carried into effect, reference will now be made, by way of example, to the accompanying drawings that show preferred embodiments of the present invention, and in which:

15 Figure 1 is a side view of a person in a standing position;
Figure 2 is a side view of person sitting in a conventional right angle position;
Figure 3 is a side view of a person sitting in a conventional saddle seat;

20 Figure 4 is a side view of a person sitting in a conventional tilt seat;
Figure 5 is a side view of a person sitting in a conventional kneeling chair;
Figure 6 is a side view of a person perching on a chair;

25 Figure 7 is a side view of a person sitting on the improved seat of this invention;
Figure 8 is a perspective view of the improved seat of this invention;

30 Figure 9 is a side view of the improved seat of this invention illustrated in Figure 8;
Figure 10 is a perspective view of a typical chair constructed with the improved seat of this invention;

Figure 11 is a perspective view of an alternative embodiment of the improved seat of this invention;

Figure 12 is a side view of the alternative embodiment of the improved seat of this invention illustrated in Figure 11;

5 Figures 13–16 are perspective views of various alternative embodiments of the improved seat of this invention;

Figure 17 is a perspective view of the improved seat of this invention including a pommel;

Figure 18 is a side view of the improved seat illustrated in
10 Figure 17;

Figure 19 is a top view of the improved seat illustrated in Figure 17;

Figure 20 is a front view of the improved seat illustrated in Figure 17 showing a person seated on the seat; and

15 Figures 21–26 are perspective and side views, respectively, of alternative embodiments of the pommel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows a typical person 10 standing in an upright position. The standing posture illustrates the natural upright curvature of the spine 12. In this position the psoas major muscle 14 pulls on the lumbar vertebrae 16 of spine 12 giving the spine its natural upright curvature. The psoas major muscle 14 extends from the thigh bone 18 to the lumbar vertebrae 16 of the spine 12.

25 In a classic right angle sitting position, illustrated in Figure 2, person 10 sits on a seat 20 with thighs 22 at roughly a 90° angle to the trunk 24 of the body. This relaxes the psoas major muscle 14 so that it no longer pulls on the lumbar vertebrae 16 of the spine 12. In general, after 30 60° of bending the hamstring muscles 26 tend to pull the pelvis 28 in the direction of arrow 30 which causes the pelvis 28 to rotate backwards, as indicated by arrow 32, and as illustrated in Figure 2. This causes the spine to become rounded. To restore an upright curvature to the spine the lumbar muscles of a person's lower back (not illustrated) work to push the

pelvis 28 forward to counteract the pull of the hamstring muscles 26. Over time the lumbar muscles get tired, and eventually stop pushing. This results in the spine becoming rounded once again and a slouching posture, as illustrated in Figure 2, becomes a position of choice since it 5 requires the least amount of muscular effort.

A biomechanical relationship has been identified between a person's thighs and spine, which has led to the creation of an open-angle seat. Open-angle seats allow the thighs 22 to drop creating an angle with the trunk 24 of the body that is greater than 90°. This results in positive 10 biomechanical changes in spinal and pelvic posture. In particular, the hamstring muscles 26 no longer pull on the pelvis 28, allowing it to roll forward, and the psoas major muscle 14 no longer completely relaxes, and so maintains some of its pull on the lumbar vertebrae 16. The interaction of these muscles allows the spine 12 to maintain its natural 15 upright curvature. There are a variety of chairs in the marketplace that utilize open-angle seats, for example, a saddle seat (illustrated in Figure 3), a tilt chair (illustrated in Figure 4), a kneeling chair (illustrated in Figure 5), and a perch (illustrated in Figure 6). These chairs all provide the biomechanical relationship identified above, and are known to those 20 skilled in the art as open-angle chairs.

One type of conventional open-angle chair is the saddle seat 34 illustrated in Figure 3. Saddle seats allow the thighs 22 to drop into an open-angle position creating an angle with the trunk 24 of the body that is greater than 90°, thereby maintaining the natural upright curvature of the 25 spine 12, as described above. Legs 36 of person 10 straddle the seat 34 so that support is provided by a surface 38 of the saddle seat 34 to the inner surface of the thighs 22 (not illustrated). This adds stability to the sitting posture, but, over time, can cause numbness and discomfort to the inner thighs. Moreover, there is no weight bearing support surface 30 provided under the thighs 22. Rather, the full downward load of the trunk 24 of person 10 is carried by a support surface 40 of the saddle seat 34 and is concentrated on the sit bones (ischial tuberosities) 42 of person 10, as illustrated in Figure 3. Over time this can be painful.

Figure 4 illustrates a conventional tilt seat 44, and Figure 5 shows a variation of the tilt seat, namely, a kneeling chair 46. Both seats allow the thighs 22 to drop into an open-angle position creating an angle with the trunk 24 of the body that is greater than 90°, thereby maintaining the natural upright curvature of the spine 12, as described above. Tilt seat 44, as illustrated in Figure 4, includes a single support surface 48 that provides some weight bearing support under both the sit bones 42 and the thighs 22. As can be appreciated from Figure 4, however, the trunk 24 of person 10 tends to slide under gravity downwardly and forwardly over the support surface 48—as indicated by arrow 50. This downward and forward motion must be counteracted by muscle activity from both the legs 36 and the feet 52 of person 10. Over time, this can result in fatigue and discomfort for a person.

Kneeling chair 46, illustrated in Figure 5, is similar to the tilt seat 44, illustrated in Figure 4, but includes the addition of a support surface 54 (usually cushioned) provided below the knees 56 of person 10 to redirect the downward pressure caused by gravity acting on the trunk 24 from the legs 36 and the feet 52 (as shown for the tilt seat 44 in Figure 4) to the shins 58. The downward pressure caused by gravity must still be counteracted by muscle activity from the legs 36, however, which can result in fatigue and discomfort to a person over time.

It is also known that perching (sitting at the forward edge of a seat of a chair) as shown in Figure 6 offers biomechanical advantages to the sitting posture. When the chair is high enough, perching allows the thighs 22 to drop into an open-angle position creating an angle with the trunk 24 of the body that is greater than 90°, thereby maintaining the natural upright curvature of the spine 12, as described above. Figure 6 shows a person 10 sitting at the forward edge of a seat 60 provided at a sufficient height above a floor to allow the thighs 22 to drop into an open-angle position. In effect, perching is the act of a person 10 bracing himself from falling off the forward edge of the seat 60 by using the muscles of both the legs 36 and the feet 52. Over time, this can result in increased fatigue and discomfort for the person. Further, perching provides no weight

bearing support under the thighs 22, so that the load of the trunk of the body is concentrated on the sit bones 42.

The open-angle seat 62 of this invention is illustrated in Figures 7 and 8, and provides independent support surfaces for the sit bones (ischial tuberosities) 42 and also for the thighs 22 of person 10, yet allows the thighs 22 to drop into an open-angle position creating an angle with the trunk 24 of the body that is greater than 90°, thereby maintaining the natural upright curvature of the spine 12, as described above.

In particular, the open-angle seat 62 of this invention includes a first support surface 64 that has a sufficient perimetrical extent to extend under a person's buttocks 66 to support the downward load of the trunk 24 at the sit bones 42, as illustrated in Figure 7. In particular, the first support surface 64 extends generally in a plane 68. In the preferred embodiment illustrated plane 68 is disposed generally parallel to a plane defined by where the chair rests upon a surface 70. Therefore, in normal usage with the chair on a generally horizontal surface 70, such as a floor, plane 68 is disposed generally horizontal. This allows the seat 62 of this invention to support from below the downward load of the trunk 24 of the body at the sit bones 42. It can be appreciated, however, that plane 68 can vary from the horizontal so long as the trunk 24 of person 10 does not slide under gravity downwardly and forwardly over the support surface as in a tilt chair illustrated in, for example, Figure 4. Further, it can be appreciated that the first support surface 64 can be a single support surface (as illustrated in Figure 8) or a plurality of support surfaces disposed in plane 68.

The seat 62 of this invention also includes a second support surface 72 having a sufficient extent to extend under and support the person's thighs 22, as illustrated in Figure 7. In the preferred embodiment of this invention, the second support surface 72 extends generally in a plane 74 and has a perimetrical extent sufficient to extend under and support the thighs 22 of person 10. To position the thighs 22 in an open-angle position creating an angle with the trunk 24 of the body that is greater than 90°, the plane 74 is disposed generally forwardly and downwardly in relation to the plane 68, as illustrated in Figures 7 and 9. It

is found that desirable open-angle benefits can be achieved by angling the generally planar extent of the second support surface 72 downwardly in relation to the generally planar extent of the first support surface 64 by an amount ranging from about 10° to about 30°. In the preferred embodiment, 5 the generally planar extent of the second support surface 72 is angled downwardly in relation to the generally planar extent of the first support surface 64 by an angle of about 20°. It can be appreciated that the second support surface 72 can be a single supporting surface (as illustrated in Figure 8) or a plurality of support surfaces (see, for example, Figure 13) 10 disposed under a person's thighs 22 in plane 74.

The front-to-back extent of the second support surface 72 should be sufficient to support the thighs 22, but not so long as to interfere with the bending of the legs 36 of person 10 at the knees 56. In general, a forward facing edge 76 of the second support surface 72 is located just 15 behind the knees 56, as illustrated in Figure 7. For an average person, the front-to-back length A, as shown in Figure 7, of the second support surface 72 is substantially equal to the length of a hand 78 of the person 10 as measured from the wrist to the end of the middle finger. This measurement is shown in Figure 1 at A. Measuring the hand 78 as 20 described provides a relatively easy and accurate way to determine the front-to-back length of the second support surface 72. It is generally difficult to obtain a direct measurement of this length from the thighs 22 of the person 10, since it is usually difficult to determine where, at the top of the legs 36 of a typical person, the thighs 22 begin. The front-to-back 25 length A can range from about 12.4 cm for a four year old child to about 21 cm for a large adult. For an average adult length A would typically be about 18–20 cm.

In the preferred embodiment of this invention, the generally planar extent of first support surface 64 and the generally planar extent of 30 second support surface 72 are joined along a common edge 80, as illustrated in Figures 8 and 9. In the preferred embodiment, common edge 80 has a rounded profile that is approximately 12 cm radius.

A chair 82 constructed with seat 62 of this invention is illustrated in Figure 10. The chair 82 can include armrests 84, 86 and a backrest 88, which can be attached to a suitable frame 90, all as is well known to those skilled in the art. In general, the chair 82 can support the 5 seat 62 in any manner known to those skilled in the art; for the chair 82 illustrated in Figure 10, the seat 62 is supported by the frame 90. So that the seat 62 supports the downward load of the trunk 24 at the sit bones 42 from below (i.e., so that the trunk of the body does not slide forward under gravity), the generally planar extent of first support surface 64 of seat 62 is 10 disposed within the chair 82 (by the frame 90 for the chair 82 illustrated in Figure 10) in a plane 68 that is substantially horizontal when the chair is resting on a surface, such as a floor, for example.

Figure 10 shows a chair 82 providing for well-distributed support and weight bearing under the buttocks 66 and the thighs 22, but 15 allows the feet 52 of a person 10 to carry some of the weight when resting on surface 70 (see Figure 7). The first support surface 64 is disposed within the chair 82 (by the frame 90 for the chair illustrated in Figure 10) at a height B above the floor 70 so that person 10 can sit in the chair with feet 52 resting squarely on the floor 70, but allowing second support surface 20 72 to provide for independent support to the thighs 22. In the preferred embodiment, height B is the lesser of approximately one-third of a person's standing height and the length of a person's legs 36 as measured from the floor 70 to a height slightly above the knees 56 (shown in Figure 1). Height B can range from about 35 cm for a four year old child 25 to about 65 cm for a tall adult. For an average adult height B would typically be in the range of about 55–60 cm. A typical chair for an adult using the seat 62 described herein, and constructed according the measurements provided, generally has the first support surface 64 at a higher elevation than the supporting surface of a conventional seat (for example, seat 20, in 30 Figure 2). The higher elevation provides for well distributed but independent support for the sit bones 42 and the thighs 22 of the person 10, yet allows the feet 52 to squarely rest on the floor 70 (see Figure 7) to provide some support. In particular, however, the generally horizontal first

support surface 64 distributes the vertical load of the trunk 24 of the person 10 across the area of the buttocks 66 to provide independent support for the sit bones 42 (which will assume the majority of the load), and the second support surface 72 provides independent support for the 5 person's thighs 22. Further, by having the first support surface 64 extending generally horizontal, the trunk 24 of the person 10 does not slide forward under gravity as found in existing tilt chairs. This relieves extra muscle activity by the legs 36 and the feet 52 of the person 10, increasing comfort.

10 Moreover, since the first support surface 64 of the seat 62 is at a higher elevation than the supporting surface of a conventional chair, a chair constructed according to this invention is easier to get in and out of.

As can be appreciated from the above description, this invention lends itself to a method of constructing a chair using the seat 62 15 that can be custom-made to specific people. The method would comprise obtaining certain measurements from the person and using those measurements to select and arrange the support surfaces 64 and 72, respectively, in the chair. In particular, the first support surface 64 for the seat 62 would be selected—including customized construction of the 20 support surface, if necessary—having a sufficient perimetrical extent to extend under and support the buttocks 66 of the person 10 for whom the chair is to be constructed for, as would be known to those skilled in the art. The perimetrical extent of the second support surface 72 should be sufficient to extend under and support the thighs 22 of the person 10. The 25 front-to-back length A of the second support surface 72, however, should not interfere with the bending of the legs at the knees 56, i.e., the leading edge 76 of the second support surface 72 should be located just behind the knees 56 of the person 10, as illustrated in Figure 7. The measurement for the front-to-back length of the second support surface 72 30 can be obtained by measuring the length of the hand 78 of the person 10 from the wrist to the ends of the fingers, as best illustrated in Figure 1, and described above. Once a suitable measurement for the front-to-back length A is obtained, the second support surface 74 can be selected,

including customized construction of the surface, if necessary. The appropriately selected or constructed support surfaces 64 and 72 can be formed or joined as a single unit (see seat 62 illustrated in Figure 8, for example), or maintained separate (see, for example, seat 62 as illustrated 5 in Figure 11 and 13), as dictated by the design considerations of the chair being constructed.

A measurement is obtained for the height B of the first support surface above a surface, such as a floor, for example. The height should be sufficient to allow a person to sit in the chair with the feet resting 10 on the floor and the second support surface providing independent support to the thighs. In the preferred embodiment this height is measured from person 10 and is the lesser of approximately one-third of the person's standing height and the length of a person's legs measured from the floor 70 to a height slightly above the knees 56, as shown in 15 Figure 1. Once the height B is determined the first support surface is disposed in the chair (held by, for example, the frame 90 as illustrated in Figure 10).

To allow the thighs to drop into an open-angle position creating an angle with the trunk 24 of the person's body that is greater than 20 90° , the generally planar extent of the second support surface is positioned generally forwardly and downwardly in relation to the generally planar extent of the first support surface. In particular, the second support surface is angled downwardly by an amount ranging from about 10° to about 30° , and, in the preferred embodiment, by an angle of about 20° . 25 How seat 62, and particularly the first support surface 64 and the second support surface 72 are secured to or in the chair is within the purview of those skilled in the art.

A chair custom-made for an individual in accordance with the above description can have therapeutic benefits, particularly for children 30 with cerebral palsy, or for the elderly. Further, the chair can be custom-made for various sizes of children, improving posture, and, as a consequence, can improve the study habits of certain children. Professionals who sit for extended periods of time, such as musicians,

dentists, surgeons, lawyers, computer operators, and assembly workers can also benefit from the seat of this invention. However it is to be appreciated that the seat of this invention can be used for a variety of purposes including chairs for the home, and even for seats found in
5 certain automobiles, trucks, or buses.

Various alternative embodiments for the seat of this invention are illustrated in Figures 11–16. All feature a first support surface 64 that is disposed in a plane substantially horizontal and having a sufficient extent to extend under a person's buttocks to support the downward load of the
10 trunk at the sit bones, and a second support surface 72 having a generally planar extent disposed generally forwardly and downwardly in relation to the generally planar extent of the first support surface 64. Again, the second support surface is angled downwardly in relation to the first support surface by an amount ranging from about 10° to about 30°, and, in
15 the preferred embodiment, by an angle of about 20°. Further, the second support surface has a sufficient extent to extend under and support the person's thighs.

In particular, the embodiment of the seat of this invention illustrated in Figures 11 and 12 has a gap 92 in place of the common
20 edge 80 of the seat 62 as illustrated in Figures 7–9. By using a gap construction of a chair can be simplified.

Figure 13 shows an alternative embodiment wherein the second support surface 72 is divided into two separate support surfaces 94 and 96. In this embodiment, the separate support surfaces 94, 96
25 provide separate support to the thighs 22 of the person 10, and can be individually spring-biased (not shown).

The alternative embodiment of the seat of this invention illustrated in Figure 14 is identical to the embodiment shown in Figures 7–9, with the exception of the addition of a cushion 98, provided over the
30 upper surfaces of the first support surface 64 and the second support surface 72, to provide for additional comfort to a sitting person.

Figures 15 and 16 show alternative embodiments of the seat of this invention featuring additional contouring to the perimetrical extent of

the first support surface 64 and the second support surface 72 that could increase comfort of the seat for certain people.

The seat 62 can include a pommel 100, as illustrated in Figures 17–20. In the preferred embodiment, the pommel 100 extends 5 upwardly from the second support surface 72. The pommel 100 provides support for the inner surface of the thighs 22 of the person 10 when sitting, see Figure 20. The pommel 100 can also provide lateral stability to the person 10 when reaching or shifting from a sitting position on the seat 62. In the preferred embodiment of this invention the pommel 100 is provided 10 on the second support surface 72 and extends upwardly and outwardly from such support by a distance sufficient so that its sides support the inner surfaces of the thighs 22. Preferably, the pommel 100 should fit snug between the thighs 22 of the person 10, but be sized so as not to cause excessive spreading of the legs 36, as shown in Figure 20. The 15 pommel 100 can be provided in a variety of shapes and configurations, as illustrated by the various embodiments shown in Figures 21 and 22, Figures 23 and 24, and Figures 25 and 26, and all as would be apparent to those skilled in the art upon reading this disclosure, without departing from the scope of this invention.

20 It can be appreciated that variations to this invention would be readily apparent to those skilled in the art, and all such variations are intended to be included in this invention. The embodiments given herein are by way of non-limiting example only, and reference should be made to the appended claims for the full scope of the invention.

WE CLAIM:

1. A seat for a chair wherein said seat provides independent support to both a person's sit bones and thighs, said seat comprising:
 - a.) a first support surface to support the downward load of a person's trunk at the sit bones, when said first support surface is disposed in a first plane; and
 - b.) a second support surface to support a person's thighs disposed generally forwardly of the first support surface in a second plane angled downwardly in relation to said first plane.
2. A seat for a chair wherein said seat provides independent support to both a person's sit bones and thighs, said seat comprising:
 - a.) a first support surface, said first support surface being generally planar and adapted to support a person seated on said seat at the sit bones of said person; and
 - b.) a second support surface, said second support surface being generally planar and adapted to support said person seated on said seat at the thighs of said person,
and wherein the plane of said first support surface and the plane of said second support surface intersect so that when said first support surface is generally horizontal, said second support surface extends generally forwardly and downwardly with respect to said first support surface.
3. A seat according to claims 1 or 2 wherein said first support surface is a generally planar surface having a perimetrical extent sufficient to extend under a person's buttocks to support the sit bones.
4. A seat according to claim 3 wherein said second support surface is a generally planar surface having a perimetrical extent sufficient to extend under and support a person's thighs.

5. A seat according to claim 4 wherein said second support surface comprises a forward facing edge and the front-to-back length is such that the forward facing edge is located just before a person's knees.
6. A seat according to claim 5 wherein said second support surface is angled downwardly in relation to said first support surface by an angle ranging from about 10° to about 30°.
7. A seat according to claim 6 wherein said second support surface is angled downwardly in relation to said first support surface by an angle of about 20°.
8. A seat according to claim 5 wherein said first support surface and said second support surface are joined along a common edge.
9. A seat according to claim 8 wherein said common edge has a rounded profile.
10. A seat according to claim 9 wherein the rounded profile of said common edge is about 12 cm. radius.
11. A seat according to claim 8 further comprises a pommel extending upwardly from at least one of said support surfaces.
12. A chair comprising a seat that provides independent support to both a person's sit bones and thighs, said seat comprising:
 - a.) a first support surface to support the downward load of a person's trunk at the sit bones, when said first support surface is disposed in a first plane, and
 - b.) a second support surface to support a person's thighs disposed generally forwardly of the first support surface in a

second plane angled downwardly in relation to said first plane.

13. A chair according to claim 12 wherein said first support surface of said seat is a generally planar surface having a perimetrical extent sufficient to extend under a person's buttocks to support the sit bones.

14. A chair according to claim 13 wherein said second support surface of said seat is a generally planar surface having a perimetrical extent sufficient to extend under and support a person's thighs.

15. A chair according to claim 14 wherein said second support surface has a forward facing edge and its front-to-back length is such that the forward facing edge is located just before a person's knees.

16. A chair according to claim 15 wherein said first support surface of said seat is disposed at a height above the floor the lesser of:

- a.) generally 1/3 of a person's standing height; and
- b.) the length of a person's legs measured from the floor to a height slightly above the knees.

17. A chair according to claim 16 wherein said second support surface is angled downwardly in relation to said first support surface by an angle ranging from about 10° to about 30°.

18. A chair according to claim 16 wherein said second support surface is angled downwardly in relation to said first support surface by an angle of about 20°.

19. A chair according to claim 16 wherein said first support surface and said second support surface are joined along a common edge.

20. A chair according to claim 19 wherein said common edge has a rounded profile.

21. A chair according to claim 20 wherein the rounded profile of said common edge is about 12 cm radius.

22. A chair according to claim 19 further comprises a pommel extending upwardly from at least one of said support surfaces.

23. A method of constructing a chair for a specific person, said chair comprising a seat that provides independent support to both the person's sit bones and thighs, the seat comprising a first support surface to support the downward load of the person's trunk at the sit bones, and a second support surface to support a person's thighs, the method comprising obtaining certain measurements and using those measurements to select and arrange the support surfaces in the chair, the measurements include:

- a.) obtaining a measurement for the height of the first support surface above a floor so a person can sit in the chair with the feet resting on the floor and the second support surface providing independent support to the thighs; and
- b.) obtaining a measurement for the front-to-back length of the second support surface so that a forward facing edge of such support surface is located just before a person's knees;

the selection and arranging of the support surfaces in the chair include:

- I.) arranging the first support surface in the chair at the height determined from step a.) above with the first support surface disposed in a first plane; and
- II.) arranging the second support surface having a front-to-back extent determined from step b.) above in the chair

generally forwardly of the first support surface in a second plane angled downwardly in relation to said first plane.

24. A method according to claim 23 wherein step a.) above comprises obtaining a measurement from the person which is the lesser of:

- i.) generally 1/3 of a person's standing height; and
- ii.) the length of a person's legs measured from the floor to a height slightly above the knees.

25. A method according to claim 23 wherein step b.) above comprises obtaining a measurement of the length of a hand of the person as measured from the wrist to the end of the middle finger.

26. A method according to claim 24 wherein step II.) above further comprises angling second support surface downwardly in relation to the first support surface by an angle ranging from about 10° to about 30°.

27. A method according to claim 24 wherein step II.) above further comprises angling second support surface downwardly in relation to the first support surface by an angle of about 20°.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 00/00754

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A47C7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A47C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 690 459 A (ULLMAN) 1 September 1987 (1987-09-01) column 2, line 5 - line 50; claim 1; figures	1-9, 12-15
A	---	10, 16, 23
X	WO 96 10937 A (DALHAUG) 18 April 1996 (1996-04-18) claim 1; figures	1-4, 8, 11-14
A	---	5-7, 9, 15, 16, 23
X	FR 2 739 008 A (GARANT) 28 March 1997 (1997-03-28) page 5, line 34 -page 6, line 5; figures 9, 10	1-4, 8, 12-14
A	-----	5-7, 9, 15, 16, 23

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

19 October 2000

Date of mailing of the international search report

27/10/2000

Name and mailing address of the ISA

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Authorized officer

VandeVondele, J

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/CN80/00754

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 4690459	A	01-09-1987	SE 456397 B AU 582393 B AU 4881085 A BE 903465 A CA 1245147 A CH 666801 A DE 3537028 A DK 479685 A, B, FI 854020 A, B, FR 2572911 A GB 2165746 A, B IT 1185458 B JP 61113412 A LU 86127 A NL 8502856 A NO 854165 A, B, SE 8405225 A	03-10-1988 23-03-1989 24-04-1986 17-02-1986 22-11-1988 31-08-1988 24-04-1986 20-04-1986 20-04-1986 16-05-1986 23-04-1986 12-11-1987 31-05-1986 24-03-1986 16-05-1986 21-04-1986 20-04-1986
WO 9610937	A	18-04-1996	NO 943820 A EP 0794718 A	11-04-1996 17-09-1997
FR 2739008	A	28-03-1997	NONE	

PARENT COOPERATION TREATY

9/926763

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 10748-3	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/CA 00/00754	International filing date (day/month/year) 27/06/2000	(Earliest) Priority Date (day/month/year) 28/06/1999
Applicant STUDIO INNOVA INC.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

contained in the international application in written form.

filed together with the international application in computer readable form.

furnished subsequently to this Authority in written form.

furnished subsequently to this Authority in computer readable form.

the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. Certain claims were found unsearchable (See Box I).

3. Unity of Invention is lacking (see Box II).

4. With regard to the **title**,

the text is approved as submitted by the applicant.

the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.

the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

as suggested by the applicant.

because the applicant failed to suggest a figure.

because this figure better characterizes the invention.

7

None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA 00/00754

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

The abstract is changed as follows:

Line 4: after "surface" insert "(64)";

line 6: after "surface" insert "(72)".

INTERNATIONAL SEARCH REPORT

International Application No

PCT 00/00754

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A47C7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A47C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 690 459 A (ULLMAN) 1 September 1987 (1987-09-01) column 2, line 5 - line 50; claim 1; figures	1-9, 12-15
A	---	10, 16, 23
X	WO 96 10937 A (DALHAUG) 18 April 1996 (1996-04-18) claim 1; figures	1-4, 8, 11-14
A	---	5-7, 9, 15, 16, 23
X	FR 2 739 008 A (GARANT) 28 March 1997 (1997-03-28) page 5, line 34 -page 6, line 5; figures 9, 10	1-4, 8, 12-14
A	-----	5-7, 9, 15, 16, 23

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

19 October 2000

Date of mailing of the international search report

27/10/2000

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Fax: (+31-70) 340-3016

Authorized officer

VandeVondele, J

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT [REDACTED] 00/00754

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4690459	A 01-09-1987	SE 456397 B AU 582393 B AU 4881085 A BE 903465 A CA 1245147 A CH 666801 A DE 3537028 A DK 479685 A,B, FI 854020 A,B, FR 2572911 A GB 2165746 A,B IT 1185458 B JP 61113412 A LU 86127 A NL 8502856 A NO 854165 A,B, SE 8405225 A	03-10-1988 23-03-1989 24-04-1986 17-02-1986 22-11-1988 31-08-1988 24-04-1986 20-04-1986 20-04-1986 16-05-1986 23-04-1986 12-11-1987 31-05-1986 24-03-1986 16-05-1986 21-04-1986 20-04-1986
WO 9610937	A 18-04-1996	NO 943820 A EP 0794718 A	11-04-1996 17-09-1997
FR 2739008	A 28-03-1997	NONE	

09/926763

PATENT COOPERATION TREATY

PCT

REC'D 09 OCT 2001

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 10748-3	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/CA00/00754	International filing date (day/month/year) 27/06/2000	Priority date (day/month/year) 28/06/1999
International Patent Classification (IPC) or national classification and IPC A47C7/02		
Applicant STUDIO INNOVA INC.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

²²
These annexes consist of a total of 21 sheets.

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 29/01/2001	Date of completion of this report 08.10.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Vesin, S Telephone No. +49 89 2399 7489



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CA00/00754

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
Description, pages:

1-16 as received on 11/09/2001 with letter of 31/08/2001

Claims, No.:

1-31 as received on 11/09/2001 with letter of 31/08/2001

Drawings, sheets:

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/CA00/00754

the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	4,9,12,14-31
	No:	Claims	1-3, 5-8,10-11, 13
Inventive step (IS)	Yes:	Claims	14-31
	No:	Claims	1-13

Industrial applicability (IA) Yes: Claims 1-31
 No: Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/CA00/00754

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. State of the art

Reference is made to the following documents; the numbering will be adhered to in the rest of the procedure:

D1: US-A-4 690 459

2. Independent claim 1

2.1 The present application does not meet the requirements of Article 33(1) PCT, because the subject-matter of independent claim 1 is not novel in the sense of Article 33(2) PCT.

2.2 The document D1 discloses:

A seat 1 for a chair (col. 1, lines 4-5), the seat 1 comprising:

a) a first support surface 2 disposed in a first plane and adapted to distribute the downward load of a person's trunk across the area of the buttocks to provide support for the sit bones (cf. fig. 1 ; col. 4, lines 27-31 and col. 5, lines 45-49); and
b) a second support surface 3 disposed substantially forwardly of the first support surface in a second plane angled downwardly in relation to the first plane and adapted to support a person's thighs (cf. fig. 1 and col. 2, lines 20-24 and 32-35).

2.3 Concerning point a), the passage col. 5, lines 45-49 shows clearly that the ischium and the carrying part of the pelvis (the buttocks) are positioned on the first horizontal support surface 2 so as to distribute the downward load of a person's trunk to provide support for the sit bones, since as mentioned in passage col. 4, lines 27-31 the whole trunk is located vertically on the ischium.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/CA00/00754

3. Dependent claims 2-13

Dependent claims 2-13 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty or inventive step. See in this respect the following passages in D1: col. 2, lines 15-19; col. 2, lines 28-35; col. 2, lines 36-50; col. 3, lines 56-61 and figure 2.

4. Independent claim 14

- 4.1 The subject-matter of independent claim 14 is novel and involves an inventive step in the sense of Articles 33(2)(3) PCT.
- 4.2 The document D1 is regarded as being the closest prior art to the subject-matter of claim 14, and discloses (the references in parentheses applying to this document):

A chair comprising a seat 1 (col. 1, lines 4-5), the seat 1 comprising:

- a) a first support surface 2 disposed in a first plane and adapted to support the downward load of a person's trunk at the sit bones (cf. fig. 1 and col. 4, lines 27-31); and
- b) a second support surface 3 disposed generally forwardly of the first support surface in a second plane angled downwardly in relation to the first plane and adapted to support a person's thighs (cf. fig. 1 and col. 2, lines 20-24 and 32-35).

- 4.3 The subject-matter of claim 14 therefore differs from this known chair in that:
the height of the first support surface above the floor is determined in use to be sufficient to allow a person's feet to be squarely resting on the floor when the person is seated on the seat.
- 4.4 None of the remaining available prior art discloses or suggests the distinguishing features of claim 14. Thus, independent claim 14 is novel and involves an inventive step (Article 33(1) PCT).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/CA00/00754

5. Independent claim 27

- 5.1 The subject-matter of independent claim 27 is novel and seems to involve an inventive step, thereby satisfying to the requirements of Article 33(1) PCT. The prior art documents from the search report do not deal with a method of constructing such a chair.
- 5.2 Claims 28-31 dependent from claim 27 are also novel and involve an inventive step, thus the requirements of the PCT with respect to article 33(1) are also fulfilled for these claims.

Re Item VIII

Certain observations on the international application

1. The subject-matter of claims 4 and 17 not only defines the subject-matter of the designated chair but also specifies its relationship to the person seated upon it in use. Thus, the requirements of Article 6 PCT are not fulfilled for lack of clarity due to claiming in terms of the intended use (cf. PCT Guidelines, III,4.8a).
2. In claims 4 and 17, the feature "height" is a parameter of the chair which is given by the size of the person seating upon it. The height of the chair depends on the size of the person's body, which varies from a person to another, thus this feature does not define the subject-matter of claims 4 and 17.
3. By definition a dependent claim includes all the features of the claim it is depending on (Rule 6.4(b) PCT), thus there is no need to repeat features of the independent claim in a dependent claim, like it is the case in claims 15 and 18 with the repeated feature "the first support surface is substantially planar".

Re Item VII

Certain defects in the international application

1. Amended independent claims should be drafted in the two-part form in

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/CA00/00754

accordance with Rule 6.3(b) PCT, with those features known in combination from the prior art (document D1) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

2. The features of the claims 1-31 are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
3. To meet the requirements of Rule 5.1(a)(ii) PCT, the document D1 should be identified in the description and the relevant background art disclosed therein should be briefly discussed.